Space Weather Technical Forecast

Issued on Saturday 8 March 2025 at 12:09 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of M-class flares (R1-R2; Minor-Moderate radio blackouts) throughout. G1/G2 likely Days 1/2. Increased chance of reaching Active Fluence on Day 4 (11 March).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity reached the Moderate level due to a single M1.6 flare from AR4016 at 07/2100UTC.

There are currently six sunspot regions currently on the visible solar disc, with most being small and magnetically simple. The largest, AR4012 now located in the southwest quadrant, is undergoing decay particularly in its intermediate and trailing spots. The second largest, AR4018 near the southeast limb, features a moderately large lead spot with some small trailer spots. AR4016, despite having decayed to a smaller and magnetically simpler spot, has been the most active, producing the only M-class flare in the past 24 hours. The remaining regions are small, weak, and either stable or in decline.

A CME (Coronal Mass Ejection), which followed the M1.6 flare at 07/2100UTC from AR4016, has been modelled and gives a low chance of a glancing blow later on Day 3 (10 March). No other Earth directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by ACE at L1, showed the onset of the anticipated coronal hole high speed stream. Winds were fairly steady at mainly slightly elevated levels 390-450km/s, until around 08/0500 UTC. Speeds then gradually increased to the range 450-500km/s. Solar wind density was around average levels before gradually rising to above average after midnight UTC, peaking 38ppcc at 08/0443 UTC. Levels gradually returned to average thereafter. The Interplanetary Magnetic Field was mainly Weak until around 08/0500 UTC then increased to mainly Moderate, peak 15nT around 08/1035 UTC. The north-south component was largely Weak and variable, but longer periods of southward orientation developed after 08/0500 UTC, occasionally reaching Moderate, peak +7/-9nT. The phi angle was positive (away from the Sun) until 08/0330 UTC, then switched sharply to negative (toward the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 was at Background.

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High energy electron flux saw a rise in its diurnal oscillation, very briefly reaching high levels of 1030pfu at 07/1735UTC. The 24-hour fluence was below the Active threshold (1e8 integrated pfu), recording 1.06e6 integrated pfu at 07/2359UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be generally Low, with a chance of further isolated M-class flares.

Solar Wind / Geomagnetic Activity: A CME, associated with the M1 flare from AR4016 at 07/2100 UTC, has a low chance for a glancing blow later on Day 3 (10 March), although the bulk of the ejecta will pass below Earth orbit.

Earth is now connected with the High Speed Stream from CH21/-. Slightly elevated solar wind speeds are expected to increase further to Elevated to Strong. Geomagnetic activity has increased to Unsettled conditions, with periods of Active to G1/Minor Storm (Kp 4-5) likely during the rest of Day 1 (08 March) and into Day 2 (9 March), perhaps with a chance of isolated G2/Moderate Storm (Kp 6). On Days 3 and 4 (10-11 March), occasional periods of Unsettled to Active (Kp 3-4) are likely, with a chance of G1/minor geomagnetic storm (Kp 5). However, overall activity should gradually weaken as the HSS slowly wanes.

Energetic Particles / Solar Radiation: High energy proton flux should remain at Background levels. High energy electron flux is likely to be background to Moderate at first, but there is an increasing chance of reaching High from Day 3. The associated 24 hour fluence is currently below the Active threshold, but is expected to rise closer to the Active threshold from Day 3 (10 March), perhaps breaching the threshold during Day 4 (11 March).

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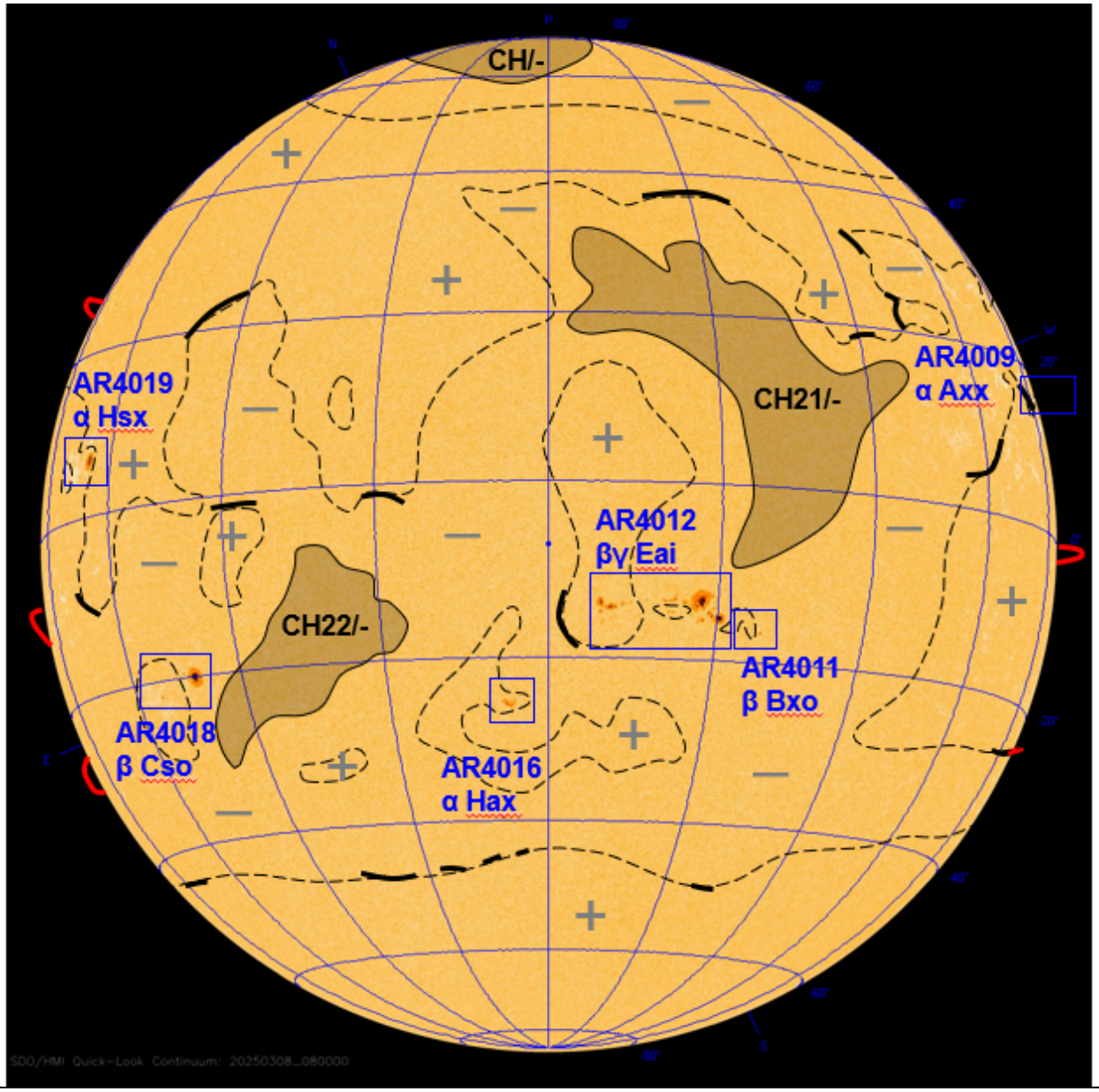
Figure 1: Synoptic Solar Map 08/0800UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

A CME which followed the M1.6 flare at 07/2100UTC from AR4016, has been modelled and gives a low chance of a glancing blow later on Day 3 (10 March).

Earth is now connected with the High Speed Stream from CH21/-. Slightly elevated solar wind speeds are expected to increase further to Elevated to Strong. Geomagnetic activity has increased to Unsettled conditions, with periods of Active to G1/Minor Storm (Kp 4-5) likely during the rest of Day 1 (08 March) and into Day 2 (9 March), perhaps with a chance of isolated G2/Moderate Storm (Kp 6). On Days 3 and 4 (10-11 March), occasional periods of Unsettled to Active (Kp 3-4) are likely, with a chance of G1/minor geomagnetic storm (Kp 5). However, overall activity should gradually weaken as the HSS slowly wanes.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	60	70	40	20
Strong	G3	No	10	10	5	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R⊙ (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed (km/s)	Estimated Arrival Time (UTC)	Comments
08/0038 UTC	Partial	Filament	AR4012 SE quadrant	992	10/1800 UTC	Slight chance of glancing blow.

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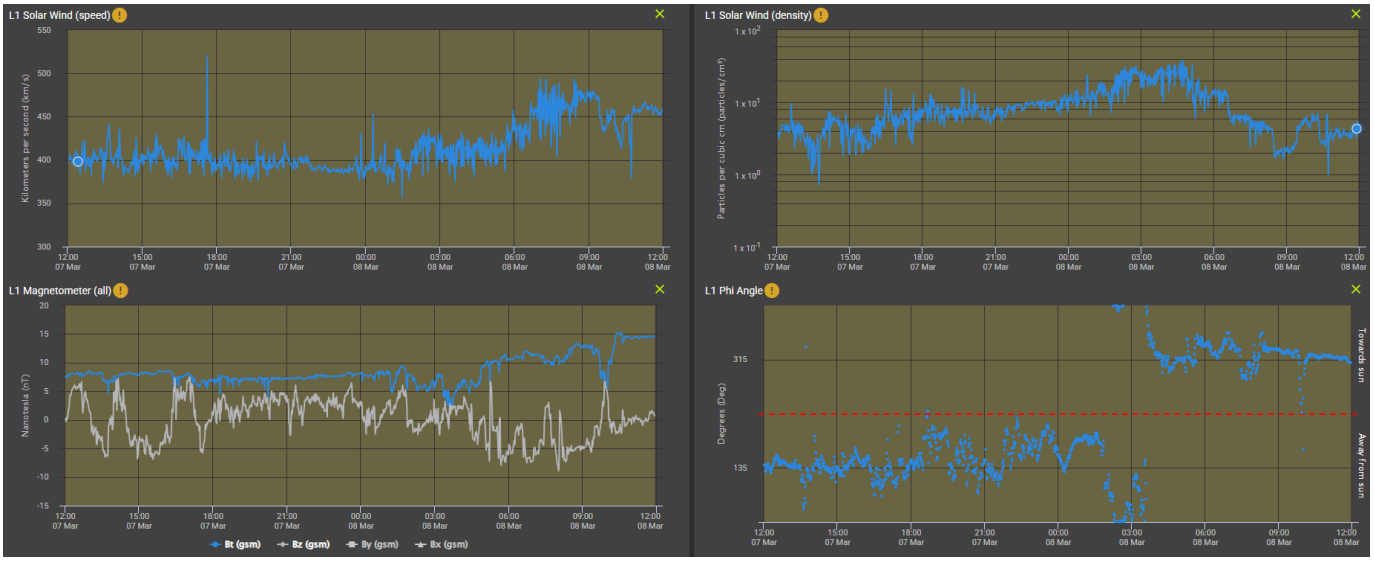
Figure 2: Solar wind parameters from the ACE satellite



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Radio Blackouts - X-Ray Flares

Solar activity reached the Moderate level due to a single M1.6 flare from AR4016 at 07/2100UTC.

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Solar activity is expected to be generally Low, with a chance of further isolated M-class flares.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**R1-R2 (M Class)**	Yes	40	40	40	40
Very Active	**R3-R5 (X Class)**	No	5	5	5	5

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Solar Radiation Storms (High Energy Protons)

GOES18 high energy (>10MeV) proton flux is at Background, and expected to remain at this level. There is a Slight Chance of an enhancement to S1 given any significant eruption from the sunspot regions currently on the Earth-facing disc.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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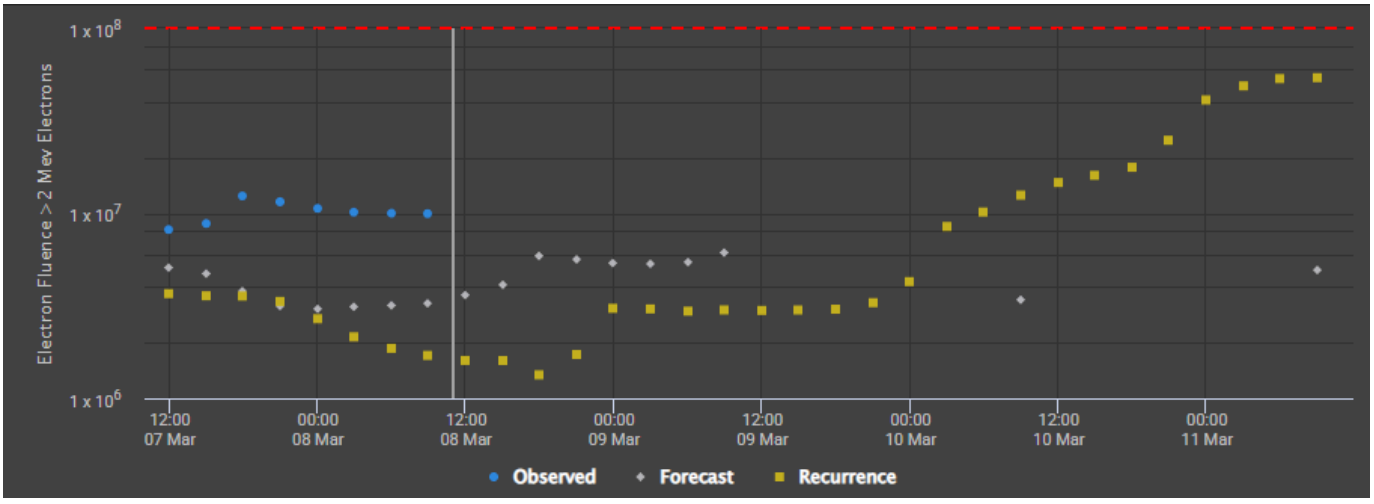
High Energy Electrons (≥ 2MeV)

The high-energy electron flux (>2MeV), as observed at GOES16, has been at predominantly Normal Background to Moderate levels, aside from very briefly touching the High level at 07/1735 UTC, and is expected to continue so at first. However, there is an increasing chance of diurnally peaking at High levels from Day 3 (10 March) due to coronal hole 21/- connection. Any glancing CME influence on Day 3 could lower this risk, but this is low confidence.

The associated 24-hour fluence is on a flat trend below the Active threshold at present, but is expected to rise closer to the Active threshold from Day 3 (10 March), perhaps breaching the threshold during Day 4 (11 March). The fluence trend is considered more likely to follow the recurrence profile than the MOSWOC REFM forecast at present.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ 1×10^8**	No	1	10	40	50
Very Active	**≥ 2 MeV ≥ 1×10^9**	No	1	1	1	5

Figure 3: MOSWOC REFM



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